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ABSTRACT

A field study tested the application of the CONSULT-I (R) program, which uses artificial intelligence with statistical pattern recognition in constructing a diagnosis and recommending treatment of reading difficulties. Participants in the field study came from 10 southern and central Indiana school districts, both public and parochial, and one Massachusetts school district. Participants included one high school dean in charge of the tutoring program, five teachers working with middle school learners, and 21 elementary school personnel. A total of 70 learners were taught by the 23 teachers who eventually completed the required data collection. Teachers completed learner profile sheets, carried out the recommendations of the CONSULT-I (R) program, and completed questionnaires at the end of the 5-month implementation period. Results indicated a positive reaction to most of the CONSULT-I (R) program: the focus in individualization and the strategies suggested were judged to be very helpful; and the negative responses showed a need for more written guidance in several aspects of the program. Findings suggest that data based diagnostic and treatment recommendations do work, and that through the use of the program, educators are able to provide an answer to the inconsistency of treatment predications for classroom teachers and reading specialists. Recommendations include: continue trials of the program in graduate and undergraduate classes; offer the program to area schools on a fee basis; and provide more written instructions. (Contains four tables of data.) (RS)

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PROFFITT GRANT FINAL REPORT
A FIELD STUDY IN THE APPLICATION OF CONSULT-I (R) TO THE PROBLEM OF INCONSISTENCY IN DIAGNOSIS AND TREATMENT OF READING DIFFICULTIES

June 1, 1989

Anabel P. Newman, Elizabeth Metz

Introduction

One of the unsolved problems in the field of reading is the inconsistency of diagnostic predictions and treatment prescriptions among reading teachers and specialists. In a series of studies conducted by Vinsonhaler, Weinshank, Wagner and Eglin (1983), it was found that

> Mean diagnostic agreement between two clinicians remained close to 0.10 across the six studies. Mean diagnostic agreement for a single clinician diagnosing the same case twice remained close to 0.20 across the six studies. In a study of remediation, the results for individual remedial agreement were similar to those for diagnosis. Further, remediations appeared to be uncorrelated with diagnosis (p. 134).

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Advanced technology now offers the possibility of a solution to this problem as seen in the following report of research conducted by Indiana University's Reading Practicum Center.

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History

A unique opportunity was offered to the Language Education Department of the School of Education, Indiana University in 1983 through the friendship of Nicholas Fattu and Leo Fay. Outcome Advisor (R) and CONSULT-I (R), computer programs designed by

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Edward Patrick, M.D., Ph.D. and James Fattu, M.D., Ph.D. (son of Nicholas Fattu) for use in medical diagnosis and prescription, were given to the Language Education Department for development in the field of education. Anabel Newman, director of the Reading Practicum Center, was asked to guide the development.

Outcome Advisor (R) and CONSULT-I (R) have not only been successful in the field of medicine for diagnosis and prescription, but also in the fields of agriculture, geology and business. Both programs are expert systems requiring expert judgment on the part of the user. The data base is entered in Outcome Advisor (R), probability densities are constructed from the data base within the program, and then this information is used to train CONSULT-I (R) for diagnosis and prescription. Both programs use artificial intelligence with statistical pattern recognition in constructing outcomes (see Artificial Intelligence with Statistical Pattern Recognition, Patrick & Fattu, 1986).

To determine the potential of the programs in education, a pilot study was conducted to demonstrate the ability of Outcome Advisor (R) to predict success as well as or better than experts in the field of reading. Standardized test scores of low readiness first graders were used to predict success at the sixth grade level (data came from longitudinal studies previously conducted by Newman, 1978, 1980, 1985). Outcome Advisor (R) predicted success slightly better than the experts (62% to 59%). This result seemed to justify further exploration.

One of the intriguing aspects of Outcome Advisor (R) and CONSULT-I (R) is their ability to take into consideration a wide

range of characteristics. This matched with the philosophy of the Reading Practicum Center (RPC) personnel who feel that the whole learner (cultural, physiological, psychological, and educational characteristics) must be taken into consideration before decisions for instructional strategies can be made. A second promising aspect was that the program, although requiring a criterion measure, did not require standardized scores to judge success. This also matched the RPC philosophy as pre and post standardized tests are not usually given to a learner. Rather, success is measured through changes in affect and attitude, and movement toward or attainment of goals. These criteria are used because after years of observation by RPC personnel, it is felt that these changes come before changes in standardized test scores. Descriptions of learner changes in affect, attitude, and success were taken from actual case studies and categorized into high, medium and low. These were then used as criteria for determining the amount of change in any individual learner.

The next step in the process was to develop a taxonomy of learner characteristics drawn from the research literature plus personal experience which might discriminate between those learners who would be highly successful in a reading program similar to that of the RPC and those who would not. The original taxonomy -- a list of 92 features each with 4 to 9 values -- was developed over a period of several months through a careful process of categorization using logical

inference to determine features and values. Included were conventional characteristics such as socioeconomic status, placement among siblings, age, and being read to before starting school as well as items such as cultural motivation (working, playing with parents), model, interests, and pressure -- variables positively correlated with reading success as identified in Newman's longitudinal studies.

To create the data base, past case studies (from 1975 to 1985) on file at the RPL were read and learner profiles coded according to the taxonomy. Case studies from 1985 to 1988 were added later. These data were entered into Outcome Advisor (R) and probability densities were run. As the data base grew, it became evident that some of the features were not discriminating between high and low success, so they were periodically eliminated until the present taxonomy of 23 features was reached with a data base of 183 learners. There are now 218 learners included in the data base.

Before CONSULT-I (R) could be trained, however, it was necessary to match successful instructional strategies with individual learners in the data base. The same two readers again read the 183 case studies to determine the one strategy which, in their judgment, had made the difference in each learner's success. Eight categories of strategies emerged: comprehension, functional language, gaming, interests, language experience, motivation, self-concept enhancement, and study skills. (While other strategies such as phonics and drills were used, they never appeared to be the turning point in a learner's experience so

are not included in the eight categories.) This most successful instructional strategy was then added to each profile, entered in Outcome Advisor (R) and probability densities run. The information from the probability densities was then used to train CONSULT-I (R) which now could be used to recommend instructional strategies for given learners.

In continuing studies students in Newman's reading methods classes (undergraduate), as well as the diagnosis classes and language practicums (graduate) and Metz' diagnosis classes and language practicums (graduate) were asked to complete profiles on each of their learners (1986 - 1989). The profiles were entered into CONSULT-I (R) and the recommendations made by the program were returned to the students. In over 95% of the cases it was felt by the students that the recommendations made by CONSULT-I (R) were on target.

During the spring of 1989 the students in both the undergraduate reading methods class and the graduate practicum were asked to track learner changes in affect, attitude and success throughout the semester.
Their use of CONSULT-I (R) recommended strategies was also monitored through monthly observations and interviews.

In addition to the studies within the university classes, CONSULT-I (R) was used by the Institute for Child Study's Interdisciplinary Clinic in cases involving reading problems. Parents, calling the Reading Practicum Center for help with their child's reading problems, were also given the opportunity to receive recommendations from CONSULT-I (R). Again, the recommendations made by CONSULT-I (R) were judged by users to be

appropriate.

At the same time as the above studies were being conducted, a booklet (Individualizing Language Strategies Using CONSULT-I (R), Newman & Metz, 1988) which would describe the various categories of instructional strategies was under development.

The strategies contained in the booklet were drawn from one or more of the cases contained in the data base and are intended to suggest successful directions for instructions for learners with certain characteristics. Completed during the field study described below, the booklet is to be used as a base for an individualized program built around the recommendations of CONSULT-I (R) and the learner's interests.

Given the successful trial of the program in these studies, it was decided to field test the program in a cross section of area schools. A Proffitt Grant was applied for and received by Newman to conduct the study over the course of a year.

Field Study

Participants. In May of 1988 several area school districts were contacted about participation in the study. All of them felt a decision would need to be made in the fall after school had started. Several individuals did contact Newman at this time in regards to updating class work needed for graduate degrees. A decision was made for them to accomplish this through participation in the field study.

School districts were again contacted in the fall and several meetings to present CONSULT-I (R) to teachers were set up. At the same time the opportunity to participate was offered

through flyers to individual schools and district newsletters. (There was no response to these.) In November the opportunity to participate was once again offered through a presentation on CONSULT-I (R) at the Indiana University's Fall Language Arts Conference.

During these preliminary meetings with teachers, individual packets containing a copy of the taxonomy, a learner profile sheet, a sample computer printout of CONSULT-I (R) recommendations, and background information on CONSULT-I (R) were distributed; the background of the program was presented: the features of the taxonomy were discussed: and the expectations of participation in the field study were outlined. These expectations included collecting learner data, carrying out the recommendations over a period of time and completing evaluation forms. The depth of discussion varied according to the amount of time (15 minutes to 45 minutes) allowed by the group for the presentation.

Although much interest was in evidence at the various meetings, it was difficult to find teachers who were willing or felt their situations would allow them to follow through and become actual participants. For example, at one meeting with Chapter One teachers, seven volunteered to participate. But, when it came time to collect the learner data, all decided that the program was in conflict with the Chapter One requirements. Three Chapter One teachers in another district did participate. At the Fall Language Arts Conference twenty three teachers volunteered to participate, but only four actually collected the data and carried out the program. Reasons given for non-

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participation included lack of time due to other demands such as a North Central evaluation and an unwillingness to ask parents for some of the information.

Participants in the field study came from ten southern and central Indiana school districts, both public and parochial, and one Massachusetts school district. They included one high school dean in charge of the school tutoring program, five teachers working with middle school learners, and twenty-one elementary school personnel. Both rural and urban areas were represented.

Data collection and processing. Gradually throughout the fall, despite the various obstacles, twenty-three teachers did collect the data and returned learner profile sheets to the Reading Practicum Center. The number of learners for each teacher varied from one to seven with an average of 3 and a total of 70. As the profile sheets came into the Center the data were processed through CONSULT-I (R). Recommendations made by the program were noted on the profile sheet.

The profile sheets with the CONSULT-I (R) recommendations; a letter of explanation

and the booklet, Individualizing language strategies using CONSULT-I (R), were sent to the teacher. In a few cases the recommendations and booklet were returned in person by one of the researchers with a short oral explanation of the recommendations.

Application of recommendations. The teachers, at both the preliminary meeting and in the letter, were asked to carry out the recommendations from October through February. Originally

scheduled to end in February, the instructional time was extended due to the varying entry times of the teachers.

Evaluation. Questionnaires were developed during the spring to be sent to the teachers at the end of the study for evaluation of the study and the progress made by the learners as evidenced by changes in affect and attitude and success (or progress) in the classroom. Directions for completion of the learner evaluation were included.

The teachers were asked to complete the forms within one week and return them to the Reading Practicum Center.

Results. The teacher evaluations of the program are shown in Table 1. Totals of the top three rankings yielded the following results:

- 100% agreed that the introduction to the program was easily understood.
- 100% agreed that the taxonomy was easily understood.
- 88% agreed that the profile sheet was easily understood.
- 88% agreed that the collection of learner data was efficient.
- 100% agreed that the recommendations for individual learners seemed appropriate.
- 100% agreed that the strategy booklet's explanations and examples were easily understood.
- 89% agreed that the strategy booklet was useful for program development.
- 83% agreed that it was easy to implement the recommendations.
- 93% agreed that the recommendations were practical for

classroom use.

- 79% agreed that the support/monitoring by RPC staff was helpful.

The areas which included negative responses were:

- 12% disagreed that the profile sheet was easily understood.
- 12% disagreed that the collection of learner data was efficient.
- 11% disagreed that the strategy booklet was useful for program development.
- 17% disagreed that it was easy to implement the recommendations.
- 7% disagreed that the recommendations were practical for classroom use.
- 21% disagreed that the support/monitoring by RPC staff was helpful.

Comments pertaining to the best part and the weakest part of the CONSULT-I (R) program are shown in Table 2. According to the responding teachers, the strategy booklet with its easy to use, practical ideas was the best part of the program. Other items mentioned included being forced to focus on the individual learner, the recommendations, the support for the classroom teacher, the variety and flexibility, and the individualized approach. As one teacher characterized her experience, the best part of CONSULT-I (R) is "making me look closely at these 5 students! We developed more of a relationship from filling out forms 'together.' I solicited answers from parents on some questions - involving them , too! I'll definitely use (an)

interest inventory in the future. My students succeeded because of improved self-concept which I could encourage from the support of your program. I am noticing reading grew the most' I wonder if writing will come as they enjoy reading to a greater extent?"

The weakest parts of the program as seen by the teachers were the collection of data for the taxonomy and implementing the strategies in the classroom.

The learner evaluations (see Tables 3 and 4) concerned with changes in affect showed that:

*73% now enjoy reading more

*79% now choose to read more

*48% now enjoy writing more

*41% now choose to write more.

Changes in attitude (see Tables 3 and 4) according to the evaluations showed

*57% have a better attitude toward learning now

*53% have a better self image.

High success as evidenced by significant progress in the classroom was demonstrated by 31% of the learners. Fifty-eight percent of the learners showed medium success (progress in the classroom) while 11% made little or no progress (low success).

Summary

The results of the study, as reflected in the program evaluations, show a positive reaction to most of the CONSULT-I (R) program. The focus on individualization and the strategies suggested in the booklet, Individualizing Language Strategies Using CONSULT-I (R), were judged by the users to be very helpful. The negative responses show a need for more written guidance in

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several aspects of the program: taxonomy, profile sheet, and group implementation.

Learner evaluation reflected changes in affect in reading in a large number of learners and in writing in a moderate number of learners. The difference between the results in reading and those in writing show the need for more emplasis on writing strategies. There were also a moderate number of learners who changed in attitude toward learning and in self-image. The smaller number of learners with change in attitude complements the previous observations of the RPC staff that affect usually changes before attitude.

Discussion

The results of this study suggest that data based diagnostic and treatment recommendations do work, and that through the use of the CONSULT-I (R) program we are now ahle to provide an answer to the inconsistency of treatment predictions for classroom teachers and reading specialists. Feedback on positive aspects of the program was provided as well as identification of areas where further clarification is needed.

Recommendations

Given the findings, we recommend the following:

1. Continue trials of CONSULT-I (R) with graduate and undergraduate classes. Prepare teachers for the possibility of implementing recommendations for individual learners.
2. Offer CONSULT-I (R) to area schools on a fee basis.
3. Provide more complete written instructions including

*a taxonomy guide for responding to taxonomy choices

*written directions for completing the profile sheet

*suggestions in the strategy booklet for implementing recommendations for group instruction.

Table 1. Teacher Evaluation of Program - Likert Scale Responses

	Strongly Agree 1	2	3	4	Strongly Disagree 5
1. The introduction to CONSULT-I (R) was easily understood.	44%	50%	6%		
2. The taxonomy was easily understood.	33%	55%	12%		
3. The profile sheet was easily understood.	35%	35%	18%	12%	
4. The method of collection of learner data was efficient.	28%	33%	27%	6%	6%
5. The recommendations for individual learners seemed appropriate.	39%	55%	6%		
6. The strategy booklet's explanations and examples were easily understood.	66%	28%	6%		
7. The strategy booklet was useful for program development.	55%	28%	6%	11%	
8. It was easy to implement the recommendations.	44%	39%		17%	
9. The recommendations were practical for classroom use.	53%	27%	13%	7%	
10. The support/monitoring by RPC staff was helpful.	29%	21%	29%	14%	7%

Table 2. Teacher Evaluation of Program - Anecdotal Responses

Best Part

Strategy booklet

Strategy book - wealth of practical, innovative ideas for enhancing curriculum

Provided many easy to use ideas, very practical

Ideas for what to do with student to increase interest in reading

Practical and useful projects to encourage reading and writing

Easy to use, efficient, material targeted well

Pinpointing of specific problem(s) and focusing on problem area to build with specific tactics

Rewarding to know on the right track, forced to evaluate all aspects of learner's environment, understood needs and motivations

Recommendations

Provides more support for classroom teacher

Variety and flexibility

Individualized approach, addressing affect as precursor to reading activities

Weakest Part

Difficult to collect data for taxonomy

Collecting learner data

Some of the items on taxonomy list were confusing

Completing profile sheet

Implementation in classroom environment

Chapter One limitations

Difficulty in implementing program in classroom without training

Most of the methods for improvement were techniques already employed in classroom

Table 3. Learner Placement Pre and Post On Affect and Attitude*

	Low	Medium	High
Enjoys reading	xxxxxoooo	xxxxxooooo	xxooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xooooo	oo
	xxxxx	oooo	
	xx		
Chooses to read	xxxxxoooo	xxxxxooooo	xooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxooooo	ooooo
	xxxxx	ooooo	
	xxxxx	oooo	
	xxxxx		
Enjoys writing	xxxxxooooo	xxxxxooooo	ooooo
	xxxxxooooo	xxxxxooooo	oo
	xxxxxoooo	xxxxooooo	
	xxxxx	ooooo	
	xxxxx	ooooo	
	xxxxx	ooooo	
	xxxxx	o	
	xxx		
Chooses to write	xxxxxooooo	xxxxxooooo	ooooo
	xxxxxooooo	xxxxxooooo	o
	xxxxxooooo	xooooo	
	xxxxxooooo	ooooo	
	xxxxxo	ooooo	
	xxxxx		
	xxxxx		
	xxxxx		
	x		
Attitude to learning	xxxxxooooo	xxxxxooooo	xxxxooooo
	xxxxxo	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	o
	xxxxx	xxxooooo	
	xxx	ooooo	
		ooo	
Self-image	xxxxxooooo	xxxxxooooo	xxxooooo
	xxxxxoo	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	ooooo
	xxxxx	xxxxxooooo	
	xxxxx	xxxooooo	
	x	ooooo	

x = Pre, o = Post *Not all teachers responded to all items.

Table 4. Changes in Affect and Attitude Over the Course of the Field Study (1) (Pre - Post).

	L - L	L - M	L - H	M - L	M - M	M - H	H - H
Enjoys reading	4	20	8		9	12	2
Chooses to read	4	23	8		6	11	1
Enjoys writing	14	18	6		13	1	
Chooses to write	21	15	4		9	2	
Attitude - learning	5	20	4	1	13	8	5
Self-image	5	16	5	2	15	7	3

L = Low
M = Medium
H = High

(1) Four to seven months depending on time of entry into study